ART. XI. *The Human Brain—its configuration, structure, developement, and physiology; illustrated by references to the nervous system in the lower orders of animals.* By SAMUEL SOLLY, Lecturer on Anatomy and Physiology in St. Thomas's Hospital, &c. With twelve plates. 12mo., pp. 492. London: Longman, Rees, Orme, Brown, Green, and Longman. 1836.

The laborious investigations, and the important discoveries, of Gall and Spurzheim, in the anatomy and physiology of the nervous system, created a new era in this interesting department of science. The methods of studying the brain generally pursued before their time, were so radically defective, that all the information acquired, amounted to

> "Little more than a vain catalogue of diseases applied to parts, without reference to their structure, their functions, or even their analogies, in the nervous system of the lower orders of animals."

Such a faulty mode of investigation could not be expected to lead to any very useful results; and we accordingly find, that the field was thereby rendered so barren, and void of attractions, that while lecturers were obliged to submit to the drudgery of burdening their memories with a formidable catalogue of hard-sounding and unmeaning terms, students either retired from it in despair, or toiled reluctantly through its difficulties, without acquiring any useful information.

The improvements which have been made in cerebral anatomy within the last thirty years, have contributed much to lead to a more rational method of studying the central parts of the nervous system; and although there are still many who adhere to the old plan of dissecting the brain by *slices*, the best informed anatomists so direct their investigations, as to unravel the intricate texture of the organ, and expose the relations and connexions between its different parts. The nerves, too, thanks to the labours of Bell, Bellingeri, Mueller, Arnold, and others, have been investigated with a true spirit of philosophy; and the numerous discoveries which have been made in this department, have added invaluable contributions to physiological science. The field, however, is not yet exhausted. Many difficulties in the anatomy and physiology of the nervous system still remain to be solved; and even the discoveries that have been made, are spread over so much space, that for want of proper co-ordination, they are not accessible, except by the few, and are almost entirely beyond the reach of the medical student. For this class of readers especially, Mr. Solly has rendered an essential aid, by collecting and condensing into a small compass, and in something of a regular form, some of the leading and prominent facts of cerebral anatomy and physiology, as they have been developed by the labours of modern times. Those, too, who are about to embark in such studies, will find great advantage from the adoption of the course he has recommended, viz:

> "By commencing with the structure and functions of the nervous system in the lowest and simplest forms of animal existence; and from this, rising by

degrees to the highest, carefully observing each addition of parts, and the relationship borne by those to an addition of function."

By pursuing this course, he will find that the complicated human brain has its type, in the lower animals, under a form of extreme simplicity, and that its fundamental parts only acquire an intricacy of arrangement in proportion as he traces them through the series, from the lowest to the highest orders; the complexity which he encounters in the latter, being a necessary consequence of the concentration of many parts into a small compass; an arrangement which is indispensable in the more perfect animals, to fit them for the performance of those important functions, so essential to their mode of existence. Commencing, therefore, with the simple, which is easily intelligible, he passes, step by step, to the more intricate and difficult part of the analysis; acquiring, nevertheless, at each stage of the investigation, a key, by which he will be able to solve all the new difficulties that may arise in his progress.

In pursuance of this course, Mr. Solly commences with the consideration of the arrangement of the nervous system in the lower orders of animals, which he traces from the ascaris, through the cyclo-neurose, (radiata,) diplo-neurose, (articulata,) cyclo-gangliated, (mollusca,) and the spino-vertebratæ, (vertebrata,) subdivisions of the animal kingdom; stating, that in a group of animals still lower in the scale, "corresponding to the *Acrita* of Mac Leay," the neurine, (nervous matter,) if it exist at all, is incorporated with the other tissues, and cannot be demonstrated as forming a separate system. This assertion is in accordance with the generally received opinion; yet, if the discoveries recently announced by Ehrenberg should be confirmed, viz: that even in the infusory animals, there is a proper nervous system, little doubt will remain of the presence of such a system in the Acrita. At any rate, Mr. Solly has expressed himself too sweepingly, when he asserts that the *polypiferous* tribes of animals are without nervous system; although so far as our present knowledge extends, this must be admitted to be true of most of the species.

It would be impossible within the limits of a mere review, to follow the author through the exposition he has given of the arrangement of the nervous system of the different classes of animals. In this he has followed, for the most part, the best modern authors, and has contented himself with giving a mere outline of their views. Commencing with the ascaris lumbricoides, because its nervous system is most simple, he quotes Jules Cloquet's description of two white cords, rather thicker in the middle of the body than at the extremities, composed of a series of small lines united at angles, or, as it were, broken, and slightly swollen at each angle, sending to the right and left filaments so thin, that they escape the eye, except when seen through a magnifying lens. In reference to this, he remarks, that to him it appears probable those cords do not represent a perfect type of a nervous system, even in its most simple form; but that in this individual it has been arrested in its developement, at a period corresponding to one of the regular stages through which the nervous system passes in the higher orders, in whom we know that the nerves are developed first, and the centres or ganglia afterwards; and in this animal, where the ganglia scarcely exist, is it not possible that the organization is incomplete; that the conducting portions of the nervous apparatus has been formed, but not the point from which the power emanates requiring to be conducted?

We cannot easily conceive how Mr. Solly could be led to adopt such an inference, except it be, that he did not carefully examine the description of Cloquet, a very essential part of which he has entirely omitted. This author says, p. 23, chez quelques individus, j'ai constaté qu'elles fomaient autour de la bouche un veritable cercle anastomotique—and again, p. 24, la disposition de ces cordons longitudinaux, les *renflements* successifs qu'ils éprouvent, les filaments déliés qu'ils donnent de part et d'autre, leur reunion autour de la bouche, &c., peuvent les faire considerer comme des nerfs munis de renflements ou de ganglions—all of which corresponds with the description previously given by Cuvier in the Leçons d'Anat. Comp. tome iv. 358. Now this seems to us to correspond very accurately with the type of the nervous apparatus in the diplo-neurose animals, and we see no necessity whatever for adopting Mr. Solly's supposition.

The Asterias are very properly taken by Mr. Solly as furnishing the type of the nervous system or the cyclo-neurose division. The nervous apparatus of this animal, first accurately described by Tiedemann, consists of a ring surrounding the œsophagus, giving off a filament to each ray, besides ten smaller ones, which he believes to descend to the stomach. The latter our author thinks are the nerves of sensation, while the former, which are distributed to the arms, are nerves of motion, page 38. Comparing this simple type with the more complicated arrangement observed in the higher classes, he thinks the nervous apparatus in the whole series may be reduced to three parts:—ganglia, commissures, and nerves.

> "The small swellings or nodules of neurine on the *ganglia.*
>
> "The cords which pass between the different ganglia, and thus connect them together, are the *commissures*, or apparatuses of union.
>
> "The cords, which are connected to the ganglia by one extremity, and the textures of the different organs by the other, are the *nerves.*"

In the remaining observations on the nervous system of the cycloneurose, as well as in those on the nervous apparatus of the cyclogangliated animals, Mr. Solly has relied chiefly upon the labours of Newport and Owen, and as his descriptions contain nothing new, we shall not follow him through the subject. A similar excuse must serve us, for passing over his remarks on the nervous system of the several divisions of the vertebrate animals.

Having disposed of the comparative anatomy in the first part of the work, Mr. Solly takes up, in the second, the consideration of the human brain; commencing first with the membranes, and then proceeding to the description of the configuration of the organ, the surface of which, he says, should be divided into two portions:—the external, or *convoluted*, and the internal, or *figurate.* We observe nothing under these heads worthy of comment; nor does the author's description of the texture of the brain deserve particular notice, except to correct an error which he has committed, in referring to Dr. M'Cartney, for the first description of the delicate membrane which incrusts the neurine, and, consequently, makes up part of the substance of the brain.

In the part of his work devoted to the description of the spinal cord, Mr. Solly follows the majority of the best anatomists of the present day, in considering it composed of four strands or bundles; two on each side, those in front being separated by a median fissure, but united by a commissure. They are called by him antero-lateral; while those behind, also separated by a fissure, are denominated posterior. The cord is composed, externally, of medullary fibres, and in the centre, of grey neurine. The most superficial fibres of the cord, he thinks, gives rise to the upper nerves, while those which are deeper seated, give origin to those nerves which arise lower down. He adverts to the opinion of Bellingeri, who described the cord as consisting of six strands instead of four, the anterior of which he considered as conductors of volition; the middle, the source of the nerves of respiration, as the par vagum, the spinal accessary, the phrenic, and the intercostals; the posterior, the regulators of the voluntary motions of extension,—flexion being controlled by the anterior. The middle strand of Bellingeri, therefore, corresponds with the respiratory tract of Sir Charles Bell; and it will be seen, besides, that there is a conformity of views between these two physiologists, as regards the office performed by the nerves arising from this middle portion of the cord. We fully agree with Mr. Solly in the *opinion* he has expressed relative to this respiratory tract of Sir Charles Bell, viz: that the evidence of the existence of this respiratory tract is not strong enough to warrant us in admitting it as an established fact. It has never been demonstrated, and even should it be, we are of opinion that there are facts predicated upon the origin of the nerves called respiratory, which could not be reconciled with Sir Charles Bell's hypothesis. We also concur in the opinion which Mr. Solly has adopted, in common with many modern physiologists, that the spinal cord is not a conductor of sensations and volitions, but a centre whence certain powers emanate, like the brain itself, though we may not yet have ascertained truly in what that power consists. The opinions recently promulgated by Marshall Hall on this subject, and to which Mr. Solly alludes, deserve an attentive consideration; and although, in our humble opinion, they do not possess that novelty which has been attached to them by some, and by their author in particular, we doubt not they will lead to the attainment of more correct views of the physiology of the nervous system, than we have hitherto attained.

A more interesting part of Mr. Solly's book, is that which treats of the medulla oblongata—there being much debatable ground, and many points upon which there is still great difference of sentiment. The following is the author's opinion of this part of the nervous system:

"In addition to the columns for motion and sensation, there are here deposited and embedded to a certain extent in its substance, four ganglia—two on each side. The most anterior of these are the ovoid bodies, which derive the name *olivary* from their form. We have already observed their analogies in moths giving origin to the par vagum; in the fish to the branchio-gastric nerves; in like manner, in man, they seem to me to be the appropriate ganglia of the pneumogastric nerves. The posterior ganglia are formed in the fissure at the back part of the cord, which is known by the absurd name of fourth ventricle. They form two projections of a pyramidal figure, and are usually designated the *posterior pyramidal bodies.* In these bodies terminate the auditory or eighth pair of nerves. These also we have remarked in the fish, under the title of tubercles of the fourth ventricle."

The corpus olivare, Mr. Solly thinks, is an important organ in the function of respiration, for the reason that the pneumogastric, which both terminates and originates in it like the spinal nerves, is a compound nerve;—a nerve of sensation in relation to the sensibility of the lining membrane of the respiratory organs, ("the *besoin de respite*"); also a nerve of motion, inasmuch as the muscles of the larynx and the muscular tissue of the trachea, bronchia, and stomach, are under its control. He adduced some experiments confirmatory of these physiological views; but while we admit the correctness of the exposition of the relations of the nerve, we are not disposed to subscribe to the accuracy of the statement made in regard to its exclusive connexion, at its origin, with the corpus olivare. We are rather inclined to consider the pneumogastric as a compound nerve in another sense, viz: having anterior and posterior roots—the former arising from the fissure behind the olivary body—the latter, very indistinct from the floor of the fourth ventricle, as described by Sœmmering, I. F. Meckel, and Bischoff. We shall not stop, however, to discuss this point, but proceed to consider Mr. Solly's views relative to the distribution of the parts composing the medulla oblongata.

"*The anterior columns or motory tracts*" are described as consisting of three sets of fibres, "one, and the most anterior of which passes through the pons varolii, and may be designated the *cerebral* fibres of the anterior columns; a second set, which may be entitled the *superficial cerebilear* fibres of the anterior columns, passing over the surface of the medulla oblongata, are usually seen without dissections."—"The third, or deep cerebilear fibres of the anterior columns, proceeding in company with those of the posterior columns, from about a fourth part of the whole diameter of the restiform bodies."—"Of the fibres which run from the antero-lateral columns, to the cerebellum, there are evidently two sets—one superficial, and one deep. The superficial may again be divided into two sets: the first cross the surface of the cord immediately below the corpus olivare, and may generally be seen without dissection." "The second of the superficial set of fibres, take the same direction; only, instead of crossing the cord immediately below the corpus olivare, they run to the inner side of the corpus olivare, and then ascending to the cerebellum, they form the outer part of the corpus restiforme.

"The deep set of fibres from the antero-lateral columns to the cerebellum, are the most posterior of the whole mass of fibres composing this portion of the spinal cord. They are separated from the posterior columns by the posterior fissure, from which the posterior roots of the spinal nerves emerge; this fissure they cross in their passage to the cerebellum, obliterating it entirely."

The connexion of these fibres of the antero-lateral columns of the medulla oblongata, with the cerebellum, Mr. Solly thinks had escaped the notice of preceding anatomists. He, however, admits, that the superficial order had been previously described, especially by Santorini and Roland, the former of whom called them processsus arciformes. The following quotation from E. H. Weber, will show how far he is correct in this opinion.

> "We sometimes find a thin layer of fibres proceeding from the lateral part of the pons varolii, or *from the cerebellum*, which winds around the corpus olivare and the corpus pyramidale, and terminates in the anterior middle sulcus. The surfaces of the two lateral halves of the spinal marrow, therefore, which encounter each other at the anterior middle fissure, exhibits conspicuous fibres, which range *obliquely from before backwards;* they sometimes pursue a curved direction, sweeping round the lower and upper ends of the corpus olivare. Santorini, Malacarne, Gall, and Spurzheim, have called them processus arceformes."*

Besides the fibres of the antero-lateral column, here described, "there is another set, which, in the spinal cord, occupies a completely lateral position, being separated from the posterior columns by the posterior peaks of grey matter. These are regarded by Sir Charles Bell as the *cerebral* strands of *sensation.*" They terminate in the cerebrum, and the posterior roots of the spinal nerves are connected with them. At page 225, Mr. Solly remarks, however, that the tract of sensation consists of two portions, the one behind the posterior fissure, and consequently named the posterior column; the other anterior to it, constituting part of the anterior-lateral column. The posterior division ascends to the cerebellum, becoming incorporated in its course with the fibres composing the restiform body. Its fibres are also partly overlapped by, and partly interlace with those fibres from the anterior columns which, ascending to the cerebellum, connect the motor, or voluntary tract of the spinal cord with the cerebellum, as well as with the cerebrum. The anterior portion of the tract of sensation, sends some of its fibres to the cerebellum; the rest of its fibres ascend principally to the outer side of the corpus olivare, and there plunging into the pons varolii, pursue their course to the *thalamus nervi optici.*

The motor portion of the pyramidal bodies passes through the pons varolii, and forms the inferior part of the crus cerebri. It then plunges into the corpus striatum, which is its appropriate ganglion, and its fibres having traversed this body, escape from it, diverging like the rays of a fan, to terminate in the cineritious neurine composing the convoluted surface of the hemispheres.

The fibres composing the restiform body pass directly to the cerebellum—none of them going to the cerebrum.

In some of his opinions we do not exactly agree with Mr. Solly. Besides the fibres composing the processus arciformis, which go to the cerebellum, we should be inclined to follow Riel, Meckel, Langenbeck, Weber, and others, in saying that the pyramidal body divides into an anterior and a posterior portion, passing in front and behind the corpus olivum, so as to include that body between them. Of these fibres, those which pass in front of the olivary body, continue through the substance of the pons varolii, to form the lower part of the crus cerebri, and afterwards penetrate the corpus striatum. The fibres, on the contrary, which ascend behind the olivary body, form a bundle which can be seen upon the floor of the fourth ventricle. Some of them are distributed to the cerebellum. Others run forward to the quadrigeminal bodies, and along each side of the aqueduct of sylvius, while there are some which can be traced through the pons varolii to the thalamus nervi optici. Rolando supposed that the corpora olivaria correspond to the anterior bundles of the spinal cord. Gall and Spurzheim represent them as ganglia, giving origin to fibres which traverse the pores, and form the upper and inner part of the crura cerebri; while, according to Langenbeck, these fibres are distributed to the quadrigeminal bodies. Mr. Solly doubts the existence of fibres originating in the olivary bodies, and regards the latter merely as ganglia, belonging to the pneumogastric nerve;—an opinion not borne out by facts. We should rather infer that they belong to the pyramidal bodies, with the fibres of which they have the same relation, as ganglia, that the corpus striatum has with the fibres of the crus cerebri, which traverse its substance, or the corpus rhomboideum with the restiform bundle. The fibres of the pyramidal body pass partly through it—partly over its surface, receiving additional fibres in their transit. They are there distributed to the various parts already indicated—not to the cerebrum alone, as supposed by Gall and Spurzheim, but also, in part, to the cerebellum. Indeed, the medulla oblongata is far from being so simple in its structure as has been generally supposed. The elements of sensation and motion of which it is composed, are no longer isolated, as in the spinal cord, but intimately interwoven with each other. Portions of both species of aliments pass both to the cerebrum and cerebellum, and while the several ganglia may be regarded as so many foci, from which certain powers emanate, or towards which certain powers are directed, the distribution of portions of both elements to the two grand divisions of the brain, serves to co-ordinate the several acts performed by the different portions of the organ. In this office of co-ordination, however, the commissures also perform an important part.

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* Hildebrandtz, Handbuch der Anatomie, besorgt von Ernst, Heinrich Weber. Bands III. p. 397. Braunschweig, 1831.

Mr. Solly next gives a brief, but, in most respects, an accurate description of the commissures. It presents, however, nothing of sufficient interest to require particular notice. We shall, therefore, pass over this part of his work.

The description of the cerebellum is copied from Mayo's translation of Reil's papers on the configuration and structure of that organ. While we admit its general accuracy—a meed of praise that has been generally conceded to the labours of the celebrated German anatomist, we are by no means disposed to think that Mr. Solly has acted wisely, in incorporating it, with all its unnecessary minuteness of detail, in a work so elementary as his is on the other parts of cerebral anatomy. Few students will be disposed to burthen their memories with the minute and tedious description of Reil; and if they were even disposed to do so, there are not many who would be able to master the subject, without the aid of previous anatomical knowledge, which they would be obliged to seek elsewhere.

We do not think it necessary to follow Mr. Solly through the description of the cerebral nerves, and the vessels employed in the cerebral circulation. The part devoted to the developement of the nervous system presents more interest, but Mr. Solly might have advantageously spared us the trouble of wading through five pages of natural theology, and Newton's meditations "on the simplicity and harmony of the laws which regulate the universe"—such things add nothing to the value of a work on the anatomy of the brain, and the introduction of them by Mr. Solly, neither indicates good taste, nor a proper regard for the patience of his reader. His description of the developement of the nervous system is compiled chiefly from Tiedmann, and need not detain us. We shall, for the same reason, pass over the part devoted to the physiology of the brain, which is made up almost entirely of a transcript of a report made some years ago to the Royal Academy of Sciences of Paris, on the work of Flourens—with the addition, however, of considerable excerpts from the works of MM. Bouillaud and Foville. Here we think the author has again erred in judgment. He would have done better, if he had made a condensed and faithful digest of the most recent facts and opinions relating to cerebral physiology, collecting all the lights into a focus, and divesting them of all the extraneous matter by which they are obscured.

We regret that we cannot speak in terms of greater commendation of the next part devoted to the consideration of "physiological inferences from pathological states." It is spread over one hundred and forty-seven pages, and, like the parts just mentioned, "is made up," to a very great extent, of cases, which, however valuable they would have been in a treatise on clinics, are entirely out of place in a work on the anatomy and physiology of the brain—designed for the use of students.

We must here close our notice of Mr. Solly's labours. We have found fault with some parts of his work, but we should do injustice both to our own judgment, and to the author, if we did not acknowledge that it possesses a great many merits. It will be found highly useful to students engaged in the study of the subjects of which it treats, and to such, we strongly recommend it. We will merely suggest to Mr. Solly, that should a second edition of his work be called for, which we doubt not, from the favourable manner in which it has been noticed by the British periodicals, will be the case, to recast the whole, and by a more lucid arrangement, together with the omission of all extraneous matter, render it a more suitable manual for the student.

E. G.